



*KNOWDIVE*



**KDI** ● **Knowledge and Data Integration**

## **Foundational Teleology**

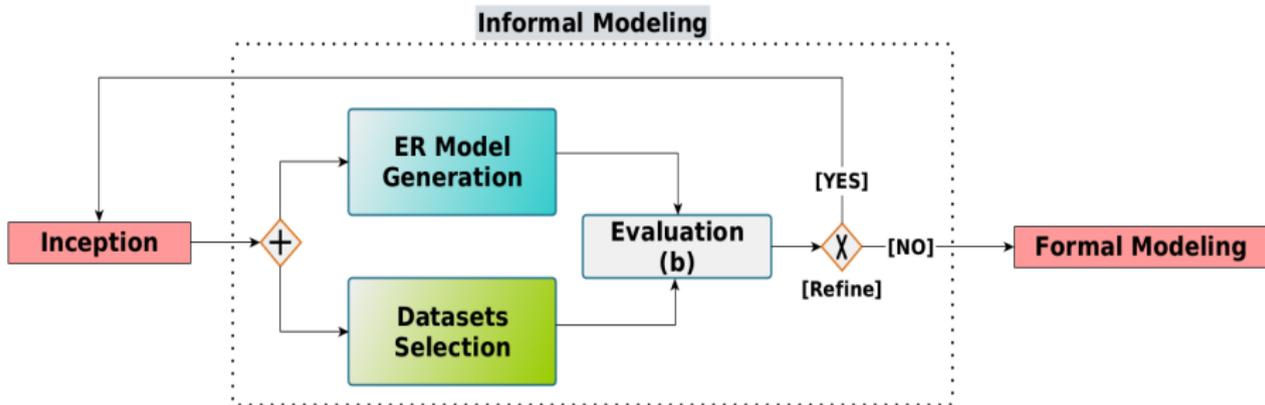
iTelos Informal Modeling Phase

**Fausto Giunchiglia, Mayukh Bagchi**

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# Informal Modeling phase



# Informal Modeling objective

Informal Modeling is the second iTelos phase

## Inputs:

- Classified Competency Question (CQ) list.
- Datasets.
- Reference teleologies.

## Outputs:

- ER Model.
- Selected datasets.

**Knowledge layer:** the KE aims to generate a model for the ETG, which is as suitable as possible for the information in the datasets selected. To achieve such a result the current phase is divided in two internal activities:

- Finalize the CQs formalization (started in Inception phase).
- Generate the ETG model.

**Data layer:** Moreover, the DS selects, from the whole set of datasets collected, only the relevant elements, filter away useless resources.

# Informal Modeling phase

## Observation 1:

In order to understand and properly execute the Informal Modeling activities, we need to be familiar with the notion of *Ontology* and, most important, we need to define what is a *Teleology* and why it is used in iTelos.

## Observation 2:

It is not possible to produce a global schema with the objective to integrate all the data available (can you model the world ?). For this reason the *Datasets Selection* activity plays a crucial role in the identification of those datasets containing **ALL** and **ONLY** the information required to satisfy the Purpose.

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# Ontology

- “An ontology is a formal, explicit specification of a shared conceptualization”  
-by Gruber (1993) and modified by Studer et. al (1998)
- Ontologies are used to capture knowledge about some domain of interest. An ontology describes the concepts in the domain and also the relationships that hold between those concepts
- Ontologies are crucial for attributing semantics to Knowledge Graphs (KGs) which model ground-truth

# Teleology - Definition

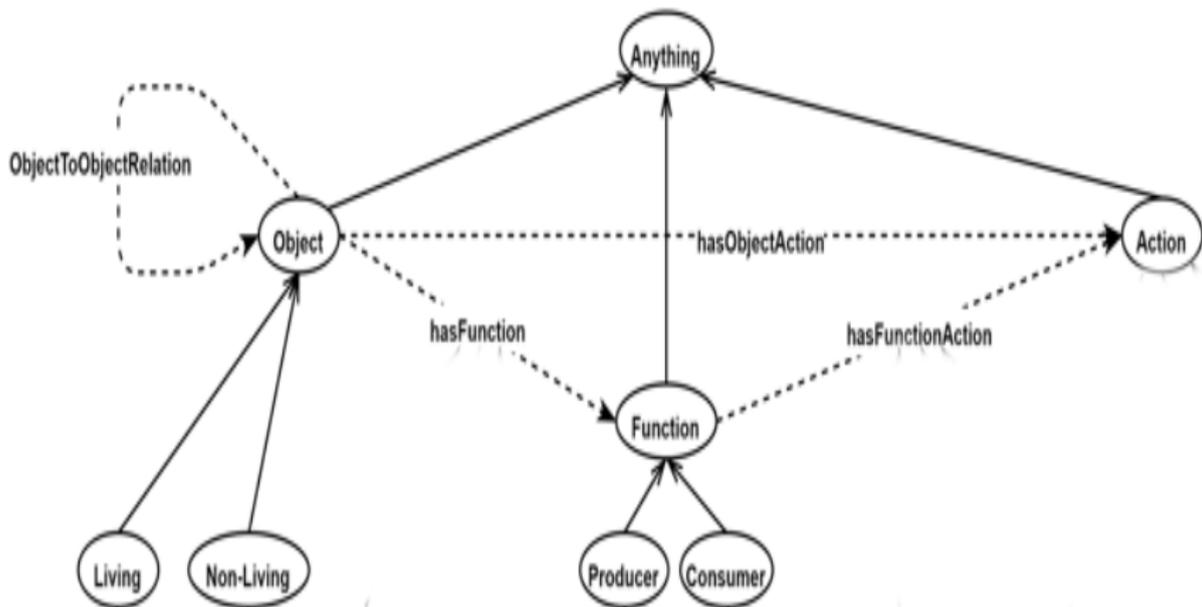
- The word *teleology* builds on the Greek words *telos* (meaning “end, purpose”) and *logia* (meaning “a branch of learning”)
- Teleology is the *study of ends and goals*, things whose existence or occurrence is *purposive*
- Concretely, in our context, *teleologies* are *ontologies* but with the proviso that teleologies focus on *function* and on how a chosen representation fits a *certain purpose*
- We focus on modelling *causality* via teleologies

# Foundational Distinctions

- In this presentation, we discuss about our *foundational teleology* (FT), the teleology which introduces the following *foundational primitives*:
  - Objects (Living and Non-Living)
  - Functions (Producers and Consumers)
  - Actions
  - Space and Time
- When we populate the foundational teleology with domain-specific *top-level categories*, we get the *Entity Type Graph (ETG)* for a specific domain
- The *ETG* is the *design basis* on which *Entity Graphs (EGs)* are designed and founded, modelling domain-specific ground truth

# Foundational Teleology - Diagram

The unified visualization of the foundational teleology -



# Anything

- Anything is the *root* of our foundational teleology.
- It is *permanent*, transcending *space-time* and *properties* (both relations and attributes)
- It is in itself beyond activity and *causation* (*cause/effect*), but serves as the *substratum* for modelling causality.
- Anything roughly maps to *owl:Nothing* with the difference that, in the context of our foundational teleology, *properties are first-class citizens* and not individuals as in OWL.

# Objects

- Objects represent *substances*, i.e., what is perceived across encounters.
- Examples of objects are:
  - cats
  - cars
  - rivers
  - ...
- Objects can be *Living* or *Non-Living* based on *autonomy*
- Objects have *spatio-temporal existence*

# Functions

- The (proper) *function* of an object *formalizes the behavior* that an *object* is expected to have
- Examples of functions are:
  - A person as *Professor, Student, Friend, Owner ...* (function as a *role*)
  - A building as *Housing, Pizzeria, Swimming School ...* (function as a *purpose*)
- An object can perform one or more *admissible* functions, where *a function is defined as a set of actions*
- Functions can be of two types - *Producers* and *Consumers*
- Functions have *temporal existence*

# Actions

- Actions represent *how objects change in time*, thus *realizing* the function
- Examples of actions are:
  - running (performed by, e.g., cats)
  - carrying (performed by, e.g., cars)
  - flowing (performed by, e.g., rivers)
  - ...
- Actions are *independent of the specific object* carrying them out; objects are abstracted away to keep track only of what changes
- Actions are *admissible* when they are valid for a particular function. For example, a car cannot be used to fly
- Actions have *temporal existence*

# Producer

- An object plays the *function of a producer* when it performs an action affecting another object
- Examples of producers are:
  - Car w.r.t *'a car transporting a person'*
  - Professor, Administrative Staff w.r.t *University*
  - Technician, Engineer w.r.t *Work Places, such as Automobile Plant*
  - ...
- Producers are responsible for modelling *cause* in *causality* (*cause-effect*)
- Producers can be consumers too, depending on the context.

# Consumer

- An object plays the *function of a consumer* when it performs an action affecting another object
- Examples of consumers are:
  - Person w.r.t *'a car transporting a person'*
  - Students w.r.t *University*
  - Showrooms, Dealers w.r.t *Work Places, such as Automobile Plant*
  - ...
- Consumers are responsible for modelling *effect in causality (cause-effect)*
- Consumers can be producers too, depending on the context
- It is important to note that *Producers and Consumers are the foundational constructs which model causality*

# Foundational Relations

- We've four *foundational relational constructs* in our foundational teleology - *hasFunction*, *hasFunctionAction*, *hasObjectAction* and *ObjectToObjectRelation*
- ***hasFunction*** relates *objects* to *functions* and illustrates the fact that - *objects can have one or more admissible functions*
- ***hasFunctionAction*** relates *functions* to *actions* and illustrates the fact that - *functions can be realized via one or more admissible functions*
- ***hasObjectAction*** relates *objects* to *actions* and illustrates the fact that - *objects can have one or more admissible functions*
- ***ObjectToObjectRelation*** models the diverse array of semantic relations existing between different *objects*

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# Motivating Example

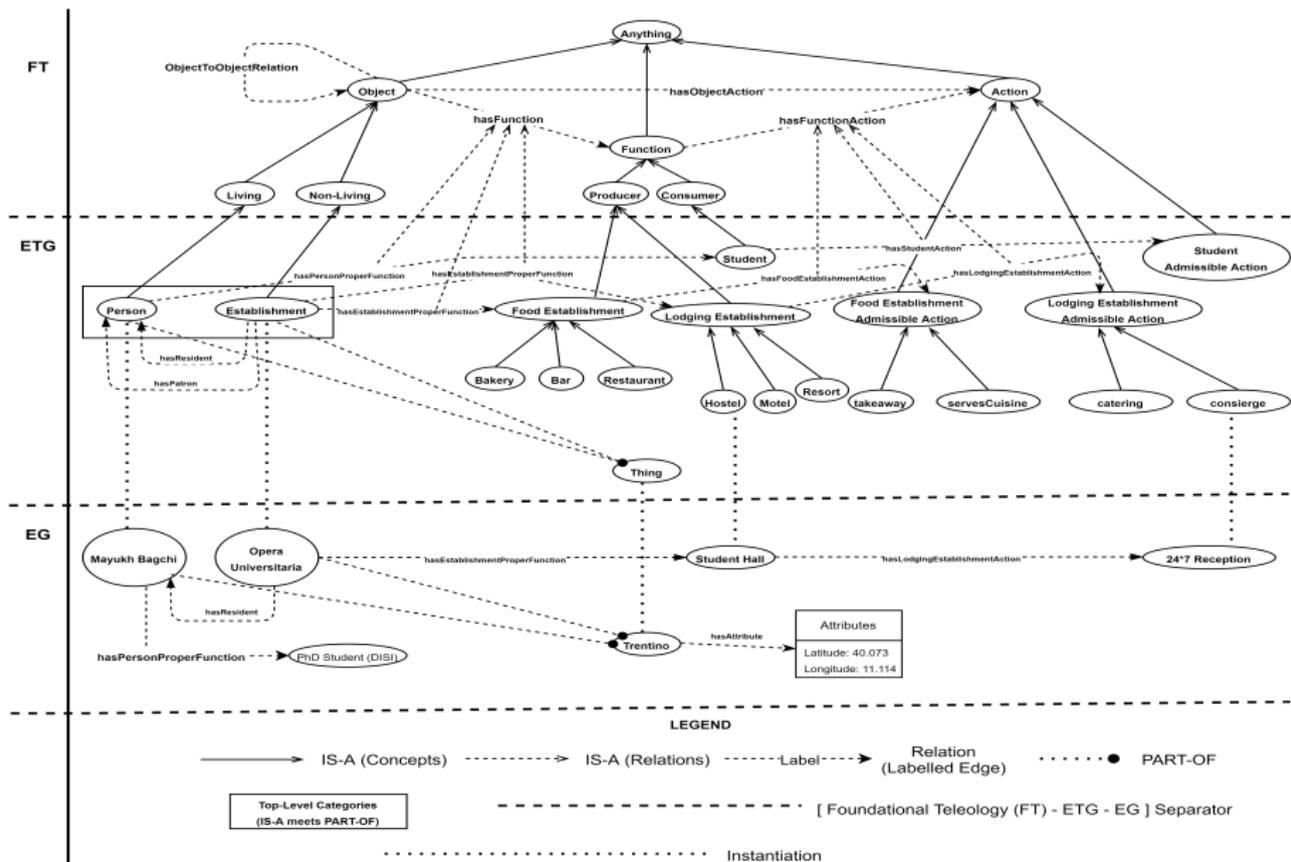
- Let us take a small motivating example from the domain of *facilities for food and accommodation* to illustrate our foundational design.
- Let us consider our *reference context* to be *Trentino*
- We now illustrate the possible modelling constructs for (partially) modelling *facilities for food and accommodation* within the scope of *Trentino* in terms of -
  - Objects
  - Functions, and,
  - Actions

# Motivating Example (Contd.)

- The potential objects in the domain of *facilities for food and accommodation* are -
  - Establishment (*part of* Trentino)
  - Person (*part of* Trentino)
  - ...
- The potential (proper) functions such objects can manifest are -
  - Bakery, Bar, Restaurant, IceCreamShop, ... (Food Establishment)
  - Hostel, Hotel, Motel, Resort, ... (Lodging Establishment)
  - ...
- The potential (admissible) actions which realize such functions are -
  - servesCuisine, takeaway, ... (Food Establishment)
  - catering, consierge, ... (Lodging Establishment)
  - ...



# Extended Visualization



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# Summary

- We learnt about the foundational distinctions which constitute our foundational teleology
- We learnt how the ETG for each domain is grounded in the foundational teleology
- We saw how our foundational choices can be applied in real-life knowledge modelling via a small motivating example from the domain of facilities for food and accommodation in Trentino
- THANK YOU !!!



KDI : Knowledge and Data Integration



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